



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/016,562	12/12/2001	Chang-Lin Hsieh	004544 ALRT/ETCH/DICP	6380
32588	7590	03/04/2004	EXAMINER	
APPLIED MATERIALS, INC. 2881 SCOTT BLVD. M/S 2061 SANTA CLARA, CA 95050			DEO, DUY VU NGUYEN	
			ART UNIT	PAPER NUMBER
			1765	

DATE MAILED: 03/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

AC

<b>Office Action Summary</b>	<b>Application No.</b> 10/016,562	<b>Applicant(s)</b> HSIEH ET AL.	
	<b>Examiner</b> DuyVu n Deo	<b>Art Unit</b> 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 15 January 2004.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |                                                                                                                                            |                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                                       | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>5/15/03</u> | 6) <input type="checkbox"/> Other: _____                                                |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

2. Claims 1-7 are rejected under 35 U.S.C. 102(e) as being anticipated by Maex et al. (US 2002/0076935).

Maex describes a method for etching organic low-k insulating layer comprising:  
providing a dielectric structure comprising a first dielectric layer such as silicon oxide (claimed

Art Unit: 1765

undoped silicon oxide) and a second organic low-k dielectric layer such as BCB, FLARE, SILK (claimed C,H-doped silicon oxide) (paragraphs [0010], [0038], [0084]), etching the dielectric structure using a plasma source gas that comprises nitrogen and fluorine atoms, wherein the second dielectric layer is selectively etched relative to the first dielectric layer (paragraphs [0040], [0057]).

Referring to claims 2-6, the source gas includes NF<sub>3</sub>, C<sub>2</sub>F<sub>6</sub>, CF<sub>4</sub> or mixture thereof and N<sub>2</sub> (paragraph [0040]).

Referring to claims 9 and 10, the plasma etching of the second dielectric layer, described by Maex, would have the same claimed selectivity to the first dielectric layer because the plasma contains the same source gas as that of claimed invention.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 8, 12-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maex as applied to claim 1 above, and further in view of Chen et al. (US 6,573,187).

Maex describes an underlying layer (paragraph [0041]). Unlike claimed invention, he doesn't describe a via dielectric layer of undoped or F-doped silicon oxide over an underlying layer and under the trench dielectric C,H doped silicon oxide. Chen describes a method for

Art Unit: 1765

forming a dual damascene structure having a via dielectric layer of undoped or F-doped silicon oxide 30 over an underlying layer and under the trench dielectric C,H doped silicon oxide 32 such as Flare, Silk, or Black Diamond (col. 2, line 55-65; col. 4, line 50-36). It would have been obvious for one skill in the art to form a dielectric structure in light of Chen because Maex describes the dielectric C,H doped silicon oxide is part of a damascene dielectric stack (paragraph [0084]) and Chen teaches various equivalent dielectric stack in order to form a dual damascene structure with a reasonable expectation of success. Figures 6 and 7 in Chen show the trench is etched through aperture in a patterned masking layer until a portion of upper surface of the via dielectric 30 is exposed for a dual damascene structure.

5. Claims 11 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maex or Maex/Chen as applied to claims 1 and 12 above, and further in view of Tao et al. (US 6,194,128).

Unlike claimed invention, Maex doesn't describe etching the low-k dielectric C,H doped silicon oxide using MERIE system. Tao shows that MERIE is used by one skill in the art for etching the low -k dielectric layer (col. 6, line 18-23). It would have been obvious for one skill in the art to etch the low-k dielectric C,H doped silicon oxide using MERIE system since it is a RIE system and Maex describes that the plasma etch includes RIE (paragraph [0039]).

6. Claims 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maex or Maex/Chen as applied to claims 1 and 12 above, and further in view of Yau et al. (US 6,245,690).

Art Unit: 1765

Unlike claimed invention, applied prior art doesn't describe depositing the C,H doped silicon oxide using a plasma-assisted CVD process. However, this process is well known to any skill in the art for depositing organic low-k dielectric layer as shown here by Yau (col. 3, line 15-50). Therefore, it would have been obvious for one skill in the art at the time of the invention in light of Yau's teaching of using plasma-assisted CVD process in order to deposit organic low-k material such as the C,H doped silicon oxide with a reasonable expectation of success.

***Response to Arguments***

7. Applicant's arguments filed 1/15/04 have been fully considered but they are not persuasive.

Response to the remark A:

Referring to applicant's argument that neither BCB nor FLARE nor SILK, taught by Maex, is a C,H-doped silicon oxide material as claimed, this is found unpersuasive because applicant has not provide evidence or fact to show that it's the case. BCB is a low-k insulating material that contains Si, O, C, H (please see US 6,168,726, col. 3, line 1-12, cited in the IDS, for further verification of its composition). This would form a low-k material with silicon oxide and C and H, which would read on claimed C,H doped silicon oxide.

Referring to applicant's argument that Maex doesn't etch the Black Diamond low k material using nitrogen and fluorine atoms, this is found unpersuasive because it doesn't respond to the rejection of citing low-k layer such as BCB cited above and it doesn't respond to Maex's teaching of etching the low-k layer such as BCB with nitrogen and fluorine atoms as presented in the rejection.

Response to remark B:

Art Unit: 1765

Please see above response concerning Maex reference. Referring applicant's argument that Maex doesn't suggest the C,H doped silicon oxide is selectively etched relative to the undoped silicon oxide. First, the fact that these are two different layers, they would have to be etched differently from each other or selectively relative to each other. Second, the plasma etching of the second dielectric layer, described by Maex, would have the same claimed selectivity to the first dielectric layer because the plasma contains the same source gas as that of claimed invention.

Referring to Chen reference, as pointed out by applicant, Chen suggests that the two layers 30 and 32 can be any materials including "SiO<sub>2</sub>, Flare, Silk, or Black Diamond." These are undoped silicon oxide and low-k materials that are used by Maex and Chen to form a damascene structure. Clearly Chen suggests that the undoped silicon oxide is used in combination with low-k materials, which would have to include Black Diamond (as suggested by Chen) or BCB (as suggested by Maex). These low-k materials would be claimed C,H doped silicon oxide. Therefore, it would be obvious at the time of the invention that the low-k material is used together with the undoped silicon oxide.

Responds to remark C:

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Applicant's argument that Tao doesn't describe forming C,H doped silicon oxide is acknowledged. However, applicant has not traversed that Tao shows MERIE is used by one skill in the art for etching the low -k dielectric

Art Unit: 1765

layer (col. 6, line 18-23). It would have been obvious for one skill in the art to etch the low-k dielectric C,H doped silicon oxide using MERIE system since it is a RIE system and Maex describes that the plasma etch includes RIE (paragraph [0039]).

### ***Conclusion***

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 571-272-1462. The examiner can normally be reached on 6:00-3:30; with alternate Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.



Art Unit: 1765

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DVD

2/26/04

